Basic concepts in Security

CNS, sections 2.1 – 2.2
NSE, sections 1.1 – 1.4
Security Architecture for OSI

- ITU-T Recommendation X.800, Security Architecture for OSI defines systematic way to
  - Defining the requirements for security
  - Characterizing the approaches to satisfying those requirements

ITU-T – international Telecommunication Union Telecommunication Standardization Sector
OSI – Open Systems Interconnection – an effort started in 1977 to standardize computer networking
OSI Security Architecture

- **The following concepts are used:**
  
  - **Security attack**: Any actions that compromises the security of information owned by an organization (or a person)
  - **Security mechanism**: a mechanism that is designed to detect, prevent, or recover from a security attack
  - **Security service**: a service that enhances the security of the data processing systems and the information transfers of an organization. The services make use of one or more security mechanisms to provide the service
Security attacks

- **Passive attack**: aims to learn or make use of information from the system but does not affect system resources.

- **Active attack**: attempts to alter system resources or affect their operation
Passive attacks

How to deal with?
Prevention rather than detection.

Figure 1.1 Passive Attacks
Active Attacks

(a) Masquerade

(b) Replay

(c) Modification of messages

(d) Denial of service

Figure 1.2  Active Attacks (page 1 of 2)
Active Attacks

• How to deal with?

• Detect and recover from disruption or delay
• It is more feasible than prevention
Security services/security attributes

- Security service is a service which ensures adequate security (a particular security attribute) of the systems or of data transfers
- X.800 Recommendation divides security services into 5 categories:
  - Authentication
  - Access control
  - Data confidentiality
  - Data integrity
  - Nonrepudiation
  - Availability service
Authentication

• The authentication service is concerning with
• assuring that a communication is authentic:
  • The recipient of the message should be sure that the message came from the source that it claims to be
  • All communicating parties should be sure that the connection is not interfered with by unauthorized party.
• Example: consider a person, using online banking service. Both the user and the bank should be assured in identities of each other
Access control

- This service controls
  - who can have access to a resource;
  - under what conditions access can occur;
  - what those accessing are allowing to do.

- Example: in online banking a user may be allowed to see his balance, but not allowed to make any transactions for some of his accounts
Data confidentiality

• The protection of data from unauthorized disclosure
  • (from passive attacks).
    • Connection confidentiality
    • Connectionless confidentiality
    • Selective field confidentiality
    • Traffic-Flow Confidentiality
Data Integrity

- The assurance that data received are exactly as sent by an authorized entity, i.e. contain
  - no modification
  - no insertion
  - no deletion
  - no replay
- Protection from active attacks
- It may be
  - integrity with recovery, or
  - Integrity without recovery (detection only)
Nonrepudiation

- Protection against denial by one of the entities involved in a communication of having participated in the communication.

- Nonrepudiation can be related to
  - Origin: proof that the message was sent by the specified party
  - Destination: proof that the message was received by the specified party

- Example: Imagine a user of online banking who has made a transaction, but later denied that. How the bank can protect itself in such a situation?
Availability service

• Protects a system to ensure its availability
• Particularly, it addresses denial-of-service attacks
• Depends on other security services: access control, authentication, etc
Attacks and Security services

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<th>Service</th>
<th>Release of message contents</th>
<th>Traffic analysis</th>
<th>Masquerade</th>
<th>Replay</th>
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Security mechanisms

- Security mechanisms are used to implement security services. They include (X.800):
  - Encipherment
  - Digital signature
  - Access Control mechanisms
  - Data Integrity mechanisms
  - Authentication Exchange
  - Traffic Padding
  - Routing Control
  - Notarisation